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A TREATISE

ON

OLIVE CULTURE,

BY

ELLWOOD COOPER.

OF

SANTA BARBARA, CAL.

SAN FRANCISCO:
CUBERY & COMPANY, STEAM BOOK AND JOB PRINTERS,
415 Market Street, just below First.
1882.

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Preface.

The following articles were written for the SANTA BARBARA PRESS and published in that Journal, commencing December, 1880.

The subject had been pressed upon me, by the numerous inquiries from all parts of the country relative to the cultivation of the OLIVE.

The articles are now compiled and presented to the public without change, excepting the arrangement of the chapters.

The sources of information are from my own experience, having planted the trees, cared for them until their bearing season, and made oil for five years. I may add, that during this period, I have read up the subject from such books as I could obtain in the French language.

There being no other work of the kind in the English language, I conclude that the effort warrants presentation.

ELLWOOD COOPER.

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A Treatise on Olive Culture.

ARTICLE I.

Propagation.

The common and preferred method is to plant the cuttings, taken from the growing trees of sound wood, from three-quarters of an inch in diameter, to one and a half inches, and from fourteen to sixteen inches long. These cuttings should be taken from the trees during the months of December and January, neatly trimmed, without bruising and carefully trenched in loose sandy soil. A shady place preferred. They should be planted in permanent sites from February 20th to March 20th, depending upon the season. The ground should be well prepared and sufficiently dry so that there is no mud and the weather warm. In Santa Barbara near the coast no irrigation is necessary; but very frequent stirring of the top soil with a hoe or iron rake for a considerable distance around the cuttings is necessary during the Spring and Summer. About three-fourths of all that are well planted will grow. My plan is to set them twenty feet apart each way, and place them in the ground butt end down, and at an angle of about forty-five degrees, the top to the north, barely covered. Mark the place with a stake. By planting them obliquely, the bottom end will be from ten inches to one foot below the surface. In Europe the trees are planted from 27 to 33 feet apart. My reasons for closer planting will be given in a subsequent article.

All trees, as a rule, should be propagated from seeds. The roots are more symmetrical, the tree not so liable to be blown over, and the growth more healthful; but I have not been successful in germinating them, hence, I recommend the cutting. If the trees are propagated from seeds, budding or grafting is necessary. I have seen the statement that it was necessary that the seeds should pass through the stomachs of birds before they could be sprouted; also that by soaking in strong lye the sprouting would be secured. I have not seen the result of either experiment, and accept the statement with more or less distrust. I presume cuttings can be obtained from any of the Mission orchards in the southern counties.

ARTICLE II.

PRUNING.

The cutting will throw up numerous shoots or sprouts, all of which should be left to grow the first year, any disturbance of the top, affects the growth of the roots. It would be advisable, however, where there are two or more vigorous shoots of about the same size and height from the same cutting, to pinch the tops of all excepting the one to be left for the future tree, so as to throw more force and vigor into that one. In the following Spring, when the ground is warm and sufficiently dry, all sprouts excepting the one to be preserved, should be carefully removed, cutting them off close to the cutting. The top end of the cutting should also be removed by the aid of a sharp saw. A post should be firmly planted, so that the tree can be well secured, to keep the trunk straight, and avoid any disturbance of the roots, and should be kept until the tree is four or five years old. By adopting this method a great deal of time will be saved, and better trees secured. The lateral branches should be allowed to grow until the tree is two or three years old; but in every case when any of said branches are rapidly making wood, they should be removed, and not allowed to rob the trunk.

In the pruning during the first years, have only the one object in view, that is to force all the woody growth into one main trunk. This being done the tree will naturally form a beautiful shape. The cultivator must not look at the tree of to-day or to-morrow, but the tree of ten years hence. All branches to the height of five to five and a half feet should be removed, so as to admit of close cultivating by horses. Trees planted at the distance of twenty feet, and well kept, will in ten years touch each other. When this condition is reached they will be in full bearing, and therefore will require constant pruning or cutting back. It is much easier and less expensive to gather the fruit from small trees; besides if the pruning is intelligently done, it will improve the fruit and secure a greater quantity to the acre than can be produced under any other conditions.

Some orchards in Europe are planted in "threes," that is three trees in each place planted in the form of a triangle, and three or four feet apart. This method would require the rows to be thirty-three to thirty-five feet distant, and would give about the same number of trees to the acre, as by planting at twenty feet, one tree in each place. It is claimed that by planting in this way no staking is required, the trees protect one another from the most violent wind storms, the trimming is simplified, and less care and labor required in the cultivation.

ARTICLE III.

FRUIT BEARING.

Trees growing from cuttings will produce fruit the fourth year, and sometimes, under the most favorable circumstances, will give a few berries the third year. It is the habit of the tree to overbear, and as a consequence will give but little fruit the year following a heavy crop. This statement is verified by the most reliable books published on the subject in the French, Italian and Spanish languages. There are, however, exceptions to this rule in California. Mr. Davis, who had charge of the San Diego Mission orchard in 1875, assured me that he had gathered from the same tree, two years in succession, over 150 gallons of berries. I have also observed that some trees in my orchards have borne well successive years. The fruit-bearing can be controlled by the pruning. The cultivator will not forget that the shoots or branches must be two years old before they will give fruit, hence, partial pruning every year, will give partial crops. My oldest orchard was planted February 21st, 1872. At four years I gathered from some of the trees over two gallons of berries. In 1878 over thirty gallons each off a few of the best trees, the orchard then being only six years old. In 1879, the seventh year, the crop was not nearly so large. I had planted several thousand cuttings in the Spring of 1873, but these trees did not give at six years, a result equal to the first planting. The present crop, (1880) is quite good; the oldest orchard now being eight years, and I think I do not over estimate, when I state that the yield of some of the best and fullest trees will be over forty gallons. Trees large enough to give this quantity of fruit, planted at a distance of twenty feet, will occupy nearly all the ground, and therefore give all the fruit that can be produced on one acre. An orchard bearing uniformly the quantity as above, would give the following result: One hundred trees to the acre at forty gallons each, 4000 gallons. This would be an enormous crop, unprecedented, and far beyond any statistics given in European publications. The one-fourth of the quantity yearly would be a very profitable crop.

In estimating an orchard, the yield of isolated trees, or trees of great age, occupying considerable areas of ground, must not enter into the basis of calculation of the probable production. The tree mentiond in the San Diego Mission orchard as yielding 150 gallons of berries was more than fifty feet distant from those surrounding it.

My agent while traveling in Europe through the olive districts, measured a tree growing in the "Alpes Maritimes" that was

eight feet in diameter six feet above the ground, and at the ground fifteen feet in diameter. Only a few trees of such size could be grown on one acre.

A. Coutance, *Professeur des Sciences Naturelles aux Ecoles de Medecine de la Marine* of France, compiled a very exhaustive work on the olive, published in Paris in 1877, from which I copy and translate as follows: "Large olive trees occupy one thousand square feet of ground—that is, require to be distant from each other about 33 feet; will produce every second year 37 gallons of berries, and occasionally as much as 125 to 150 gallons. One tree, nine years old and nine inches in diameter, will produce 16 1–5 gallons. One 12 inches in diameter, 24 gallons. The measurement and number of trees occupying one hectare (two and a half acres) is given as follows: 15 trees 12 inches in diameter, 75 trees 9 inches in diameter, 60 trees 5 inches in diameter; total, 150 trees. Product of the same, 3000 gallons of berries." This would be equal to 1200 gallons to the acre. Another authority gives 2250 gallons per hectare. Still another gives 2150. All of the above results once in two years. Several authorities quoted by the same author reckon 200 trees to each hectare. This would be 80 trees to the acre, and distant apart 23½ feet. French cultivators give the quantity of oil contained in a given quantity of fruit as one-eighth, and in weight one-tenth; that is, eight gallons of berries to one gallon of oil, and about fifty pounds of berries to one gallon of oil. Taking the average quantity of the production as given above, from a mature orchard, we have in oil, per tree, two to two and a half gallons every second year. This result is obtained by thorough fertilizing, without which the berries would yield but little oil.

Olive trees grown from seeds are not removed from the nursery until about seven years old; grown from cuttings, they bear in Europe as early as they do in California.

The newness and richness of our soil will probably give, the first fifty years, double the best results given in those countries where oil making has been the business for so many generations. Our climate is congenial to the habit of the tree; it blooms from the 1st to the 10th of May, and the fruit forms from the 1st to the 10 of June. At this season we have our best weather, free from extremes of either cold or heat. Nowhere in the world are all the conditions so favorable to the perfect fruit-bearing.

ARTICLE IV.

Fruit Picking.

The olive usually ripens in November. In some localities in Eastern countries during favorable years, the fruit picking for oil begins as early as October, and for pickling, in September. In Santa Barbara the crop of last year, (1880) as also that of 1878, was unusually late in ripening, not being ready to pick before the middle of January—a delay of fully two months—the cause no doubt owing to the extraordinary rain fall of these two years. In 1878 we had after the middle of February, and up to the middle of April, a rain fall of over 14 inches, and in 1880 over 18 inches, being more than our yearly average.

The fruit should be gathered as soon as it turns purple, and before fully ripe, as the oil will be lighter in color and more fragrant, but somewhat less in quantity.

In Europe the common method of gathering the berries is to knock them from the trees with poles; they are then picked from the ground by old men, women, children and cripples. This plan has serious objections, the fruit being more or less bruised, causing decomposition, and the contact with the earth is liable to give the oil an unpleasant taste and odor. The more economical plan of gathering, is to pick from the trees by hand, and by the aid of intelligent contrivances; an active man can pick 400 pounds each day.

I have arranged on a ranch wagon, platforms with ladders securely fastened, so that the fruit from the different heights of even large trees, can be gathered from the wagon, which is driven along the rows, and one half of the trees picked from each side. This plan obviates the necessity of moving ladders, climbing, etc., and relieves the pickers from the labor of carrying the fruit, as the sacks containing the same are always at hand on the platform. The leaves and imperfect berries are separated by passing the whole through a winnowing mill. This process leaves the fruit in the best possible condition, preparatory to manufacturing the oil.

ARTICLE V.

MAKING OIL.

The berries are dried before crushing, as it is necessary to evaporate a portion of the water. If, however, they are left out on the trees until shrivelled, which is proof that necessary evaporation has already taken place, no drying is needed after picking. This late picking is not best, as mentioned in a previous article. If dried by the sun, it requires about fourteen days. This plan cannot be depended upon, excepting years when the fruit is early ripe, and we have continuous sunlight, with moderately warm weather. By artificial heat ranging from 110° to 130°, the drying can be done in less than forty-eight hours. The crushing and pressing should follow without delay—that is, the fruit taken from the drier in the morning should be crushed and pressed the same day. Long intervals or delays in the process from picking the fruit to expressing the oil tends to rancidity. To make perfect oil requires a perfect system in the whole management. The capacity of the press, the crusher, the drier, and the number of pickers should correspond or be about equal; all fruit picked during the day should be in at night, cleaned the following morning, and go into the drier immediately after the previous day's drying is taken out. The heat or temperature of the drier ought to be so graded as to complete the work in 48 hours, and it is better that it should be under 130 degrees rather than above. Economy will necessitate in the business a system in the different branches of the process admitting of no delays from the beginning to the end.

My drier has a capacity of 500 square feet of surface, and will contain at one time over 2000 pounds of olives, equal to five pickers of 400 pounds each per day, and as much as the crusher and press I am now using can work.

The almost universal method of crushing the berries is by a heavy stone, similar to a mill stone, which is rolled around on the edge in a deep circular groove or trough, and by its weight does the crushing. A beam passing through the eye of the stone, and working on a journal in the center of the circle with a horse attached to the outer end of the beam, is the simplest way to do the work, and the plan that I have adopted. The circumference of the trough depends somewhat on the size of the stone. The one I am using is four feet high, six inches thick, and the diameter of the trough in which it works, six feet; the length of the beam fifteen feet. This crusher is amply sufficient for an orchard of one thousand trees, but too small for my purpose. It cost about 50 dollars.

A stone five feet in diameter and two feet thick would crush in eight hours a sufficient quantity of berries to make 100 gallons of oil, and by working it night and day, the crop of ten thousand trees. It would be better, however, to have two stones half the thickness of the above, one following the other in the same groove. The horse should work on the outside of the building containing the crusher.

To make 100 gallons of oil each day would require two good presses. The one best adapted for the purpose so far as I have seen, is that used for making oleomargarine. Such presses could with very little expense be worked by the horse power used for crushing the berries, so that one man could do all the crushing and pressing.

The press I am using is an old fashioned wooden beam press, such as used in the New England and Middle States for making cider. The beam is 26 feet long, and with a heavy box filled with rock suspended at the extreme end, the power can be increased to 150 tons. The press with the differential pulleys cost about $150. Such a press cannot be improved upon for expressing the oil, but the additional labor, and the time lost in changing is so much greater than what would be required for the oleomargarine invention, that the latter would facilitate the work, and be cheaper in the end, besides taking up so much less room.

The crushed olives are put in the press in cheeses about three feet square, and three inches thick, with wooden slats between each cheese. Ten or more cheeses can be put in at each pressing. I use coarse linen cloth to contain the crushed olives.

The fluid that is expressed is put in large tanks, and left for sixty to ninety days, when the oil will separate, and being lighter will rise to the top, where it can be drawn off. The pomace after the first pressing is re-crushed, and by pouring hot water over it, a second quality of oil is expressed. The refuse can then be used either for fuel, for feed for pigs, or for making still a third quality of oil; if for the latter, it is thrown in vats, boiling water poured over it, and left to ferment, when the oil still remaining will be liberated and rise to the top.

ARTICLE VI.

FILTERING OR CLARIFYING.

This is a simple process. The most common method is to have a series of five or six boxes, one above the other, each with cotton batting in the bottom, the oil passing the sixth will be beautifully clear and ready for market. I use cylindrical tin vessels holding about three gallons each, one fitting in the other in tiers of three, with fine wire sieves in the bottom of each. On these sieves I place two or three layers of cotton batting. The oil is passed from one tier to the other until clear. The clarifying can be done by the sunlight, also, it can be bleached and made much lighter in color, but not without injuring it. When it is adulterated artificial heat is necessary in the process. When once heated it loses a part of the nutty flavor, and is liable to become rancid when exposed to the air. It should be kept in an ordinarily cool place, not exposed to sunlight or heat, neither should it be handled any more than is absolutely necessary in the filtering and bottling, and should not be shaken after bottling. The mucilage contained in the oil will not separate for a long time after the oil is ready for use, and, as it does not injure it, is not, therefore objectionable. It will sometimes form in the bottles like globules of water, or in films settling to the bottom as sediment, and when shaken will give it a muddy appearance, which, with the common prejudice against all table oils that are not perfectly clear, renders it unsalable, as consumers consult more the eye than the taste. The oil is better when new and fresh, and what is gained in the appearance by its remaining a longer time in the tank, is more than lost in its freshness and delicacy of flavor.

To sum up the cost of the machinery in the making of the oil, we have as follows; Drier, $150; mill, $250; two presses, $500; two tanks, $200; filterers, $50; corker, tin foiler, $50; wooden building, $400. Total, $1600.

ARTICLE VII.

Pickling.

There are different methods of preparing the fruit for pickles. The one adopted in this locality is as follows: "The berries are put in fresh water, which should be changed every day, for forty or fifty days, then put in salt brine, not very strong, and after remaining a few days, drawn off, a second brine substituted, made nearly strong enough to bear an egg. The water should be boiled. Keep the olives well covered with the brine. Great care should be taken in handling the berries so as not to bruise them. The easiest plan when picking from the tree is to drop them in water. They are usually picked when they begin to turn a purplish color."

Another method, copied from the *Pacific Rural Press:* "Pick the olives as soon as they begin to show a reddish cast and rinse them in clean water. Then take one ounce of concentrated lye and dissolve it in water. One-third of this solution put in water enough to cover one gallon of olives. After a day or two pour off this water and add another lye of the same strength. This may be repeated once more, as five or six days are consumed in taking out the bitterness with the lye. The lye should be used until the fruit suits the taste. Then the olives are put in pure fresh water until the alkali is well removed. This can be ascertained by the color of the water and by the taste. In salting, use the best Liverpool "coarse fine" salt, the amount being about ten pounds to the barrel of olives, water enough being used to cover the fruit. Barrel up tight and keep in a cool place. All the process should be conducted in the dark, as the light is apt to injure the color."

Still another method, which I have copied from the work of Prof. A. Coutance, and translate as follows: "Take green olives and after having bruised or broken them slightly, soak in water for nine days, changing the water each day. At the end of this time they will have lost their bitter taste and can then be put in brine. Hot water acts more rapidly."

"The celebrated olives pickled after the *manner of Picholini* are put under a treatment of lye made more alkaline by the addition of quick lime. After leaving the olives a certain length of time until the pulp separates easily from the seed, a condition which depends upon the strength of the lye and the size of the olives; they are then washed and put in strong brine." "In the south they flavor with fennel and coriander; sometimes they substitute in place of the seed a small piece of *anchovy* and a *caper*. In the latter case the olives should be in oil."

ARTICLE VIII.

DISEASES.

My attention was called, as early as 1874, to the condition of the trees in and around Santa Barbara, from the ravages of the "Coccus Oleœ," commonly known as the "black scale," and which was always followed by the black fungus. In 1875 I visited the orchards of San Diego, San Gabriel, San Buenaventura and Santa Barbara, and in 1876 San Luis Obispo. At the latter place I learned from the Mission Fathers, through the late Hon. Judge Murray, that the disease had appeared about fourteen years before that date, fixing the date of its appearance in California at about 1862. Prior to that time they had had uninterrupted success with their olive trees. These examinations, very carefully made, determined in my mind one of two alternatives, either to keep the trees free from the the scale-bug or root them out. I chose the former, and have been fighting it without any cessation ever since. I believe all my olive trees are clean, and are, at this writing, loaded with a beautiful fruit crop.

An olive tree once attacked with the scale-bug, unless cleaned, will soon be infested so that it cannot bear fruit. Such fruit as is borne during the period of rapid increase of the insect, will not make oil. There are trees enough in the southern part of the State, if properly cleaned and cared for, to produce many thousands of gallons of oil, while, with a few exceptional orchards I do not believe one single gallon could be made. This is the condition everywhere where the insect is prevalent. The attack is fatal unless it is at once destroyed, and it is useless for any orchardist to fortify himself behind theories, that something will turn up to counteract the ravages, or that the ants will destroy them, or that some enemy or parasite will appear to do the work which he cannot escape. The whole business will be bankrupted any thing short of total annihilation of the insect. In some districts on the northern coast of the Mediterranean, the spread of this insect has become so alarming that the question of abandonment is contemplated. The ravages have baffled the efforts of their wisest men. To give some idea of the rapidity with which it will spread, I quote from a very interesting treatise—a pamphlet of ninety pages, written by Alfred Lejourdan—agricultural engineer, published in Marseilles, in 1864, title "Maladie Noire." It is in this work estimated that one female "Coccus" will produce from 2000 to 4000 eggs. By one author that one "Coccus" in five generations will produce

FIVE BILLIONS, NINETY-FOUR MILLIONS.

By another that ten generations are produced in one year, and

allowing only 100 as the reproduction of each—we will have at the end of the year from one single female, one billion billion—fortunately for us there are too many things contingent that prevents the possibility of such increase—high winds, birds and insects of various kinds destroy the greater number; still in favorable years the rapidity with which they will spread, will require our greatest energies and intelligence to counteract.

In a very exhaustive work on the olive, compiled by A. Coutance, Professor of Natural Science in the school of medicine, published in Paris in 1877, it is claimed that the silence of authors on this malady, caused during a period of twenty years, great ravages. Let us not commit the same blunder, and if we are to foster the culture of the olive in this country; the valuable portions of such works as above mentioned, and of other books on the subject, should be translated into English and made accessible to all the cultivators where the olive can be grown.

The ravages of this insect are of quite recent date; Lejourdan states that it appeared for the first time at Nice in 1743, and that Bernard wrote on the subject in 1783, that there were no other writers before that time.

"That all the Roman authors of the first half of the eighteenth century were silent upon the subject. It was in 1783 that all the proprietors in some localities trimmed down their trees to mere trunks, in order to clean them and commence with new trees.

It is certain that a malady so characteristic with such a disagreeable aspect could not have escaped the observation of authors.

Abbe Coutoure presented a memoire to the Academy of Marseilles, about the same time that Bernard wrote, in which he declared that the Coccus Oleoe was observed for the first time in 1781. Captain Cousin states that in 1861 this malady made terrible havoc in Kabylie, (a part of Algeria,) where the olive formed almost the only resource of the people. It was the more alarming because they could find no successful remedy. In Cousin's report, he makes the statement that the greater part of the Kabyles preferred to leave the trees without any effort to remove the insects or the black fungus, and that an orchard attacked would not give fruit before ten years; thus intimating that the disease would die out of itself in about that time. I have found in no other writings any intimation or possibility of the let-alone theory accomplishing the work.

Regarding the Coccus and the black fungus, there are various opinions; some contend that the black is caused by the humidity and the want of ventilation and sun-light in the tree. This theory is accompanied by the statement that the black fungus is

seen without any appearance of the Coccus; and that the Coccus is to be seen without any appearance of black fungus. Some that it is caused by the smoke from chimneys; others that it is caused by the northern winds carrying the sea air through the trees; others still that it emanated from the ground. But the principal and accepted theory is, that it is caused by the attack of the Coccus; the piercing of the bark of the limbs and twigs, by these little insects causing the emanation of sap, or some substance from the tree or from the insect, or both, which falls on the upper side of the leaves, as also on the trunk and branches, and produces the fungus.

In my examinations and observations I have never seen the black fungus unless preceded by the insect, and that where the tree was affected, the black was always on a lower level than where the insect was working; proving conclusively that the black was only a consequence of the insect work; and sometimes when there are comparatively few insects on a tree, it may be several months before there is any appearance of black.

When the fungus completely covers a tree, it is quite possible to destroy the insects and the black will remain for a long time afterwards; in fact when the trunk and branches, or limbs are completely coated, it is very difficult to get it off; it becomes a paste and adheres as firmly as glue, and cannot be removed without the application of strong soap or some other substance equally powerful. It is my opinion that with little care large districts could be kept free from this scale insect; I do not believe they would spread a distance of ten miles, unless carried on plants. Birds will spread them readily a distance of two miles.

In closing this part of the subject I lay down the following facts :

1st. That severe frosts will kill the insects, but the number of degrees and limit as to time through which the cold should be extended, and yet not do serious injury to the tree, is beyond my knowledge, for the reason that I have had no opportunity to extend my investigations.

2d. That trees planted close to the sea will resist the attack better than anywhere else. The cold sea winds evidently counteract the spread of the insect.

3d. That high table lands or plateaus will be easier to keep free from the insects than on bottom lands where there is more moisture in the soil, and generally more humidity in the atmosphere.

ARTICLE IX.

Remedies for the Diseases.

Pruning is the most essential thing and the remedy of the greatest vital importance. If trees are properly pruned, so as to admit of free circulation of air and the sunlight, more than half the battle is made; in fact, trees in such condition where the ground is well tilled and kept free from rubbish are not so liable to the attack, and if attacked each scale insect can readily be seen and should be removed without delay.

Orchardists who adopt this plan will have very little trouble, even in badly infected districts. A casual examination of several different parts of each orchard should be made as often as once a month. This can be done on horseback, or in a light wagon; and in the event of the appearance of scale insects, then a careful examination in that part, and a remedy applied to exterminate them. The insects will be found to inhabit that portion of the tree where the foliage is most dense, where the sunlight is shut out, and free circulation prevented. There is not so much in the remedy as in its application. While certain remedies may be effectual in the hands of some, in the hands of others they will not be sufficient. "*Eternal vigilance is the price of success.*" Constant watching and constant fighting is the only sure plan to prevent the spread of insect pests in localities where trees are affected.

There are doubtless very many remedies that if properly applied would accomplish the work; and the expense would not be so great as to absorb the profits to be derived from the products of well-kept orchards. On young olive trees not badly affected, whale oil soap can be applied with a stiff brush very successfully, and at cheap cost; but on large trees this plan is impracticable.

I find in French books, where the subject is treated at great length, numerous remedies advised, which I translate as follows:

"*Scraping off,*
Powdered Sulpher,
Petroleum,
Boiling Water,
Lime Water,
Hyposulphite of Lime,
Wash with Alkaline,
Smoking with Coal Tar."

Also, "proper drainage, the tillage, removing rubbish, the lopping off of every useless twig are necessary precautions; the application is difficult and the success uncertain, where there are millions of insects. The pruning is of the greatest importance,

and the orchardist who neglects this important part will find that the pests will resist all efforts at extermination."

In my correspondence several years ago with Prof. J. E. Planchon, President of the Horticultural Society of Montpelier, France, the following was recommended:

"Syringe the trees with a solution of sulphate of soda, and powder them immediately after with powdered lime—a caustic soda is then produced which destroys the insects." Bisulphide of carbon has been used with deadly effect on the most dangerous enemy to citrus fruit that was ever known. The cost is moderate, and the application not difficult, so that it should attract the attention of fruit-growers as an insect-destroyer.

The remedies that I have experimented with are whale-oil soap, a decoction of tobacco, phenyle, and pyroligneous acid.

1st. Whale-oil soap, as I have already stated, can be used effectually on small olive trees, at very cheap cost.

2d. A decoction of tobacco is simple, inexpensive, and, if properly applied, an effectual remedy for every class of insect pests that I have come in contact with. Forty pounds of good, strong leaf tobacco, thoroughly boiled in water, will make about 80 gallons. This can be thrown upon the trees with a garden syringe, but it is necessary that the decoction should be kept, while using it, at the uniform temperature of 130 degrees. Hotter than this will destroy the embryo fruit; less hot, less effectual. I would recommend four applications each year, until the orchards were entirely free from insects. Then, if the neighborhood was free, and proper precautions taken with pruning alone, could be kept free for generations to come. Every orchadist must grow his own tobacco, which he can do in a small way, if he attends to it properly, at a cost of two cents the pound—(one acre will produce 4,000 pounds.) We have, therefore, allowing two gallons of the decoction to a tree for each application, the following cost: One pound of tobacco, two cents. Two men can boil the tobacco and syringe 100 trees daily—$1.25 for each man, and board, would be $2.50—or two and a half cents the tree, which, with the cost of tobacco (two cents), equals per tree four and a half cents—four times each year, eighteen cents. On olive trees producing 50 gallons of berries (valued at 4 cents the pound), the whole cost of thorough cleaning would be less than two and a half per cent. of each yearly crop. On orange, lemon and lime trees, about the same.

3d. Phenyle. With this remedy my personal knowledge is limited; but from the experiments made by others, I am satisfied it has very valuable properties, and do not hesitate to recommend it. It costs $1.50 per gallon—can be diluted with 50 parts of water to one part of phenyle, making the cost of the dilution for a tree-wash only 3 cents each gallon.

4th. Pyroligneous acid is probably more effectual than any other known remedy, but the present cost of 75 cents the gallon makes it too expensive for common use in syringing trees. It is my opinion that it can be manufactured for 10 cents the gallon, perhaps less, then diluted one-half with water, would make the admixture cost 5 cents the gallon. The labor in applying either in swabbing or syringing trees, is much less than with tobacco, as it does not require to be heated. The most important properties that any remedy can possess, provided that it has about the same insect destroying power, is that it should not be disagreeable to handle, no unsafety in keeping it in any place, and that it should not require to be heated to be effectual. If it is dangerous in itself, the orchardist will always be in dread; if it requires heating to a certain number of degrees, the many little necessary preparations will afford ample excuses for delays, or if it is exceedingly disagreeable to handle, the putting-off plan will always be resorted to, until dire necessity compels its use. This remedy is not disagreeable to handle, and can always be kept at hand and ready for use. It therefore recommends itself for universal application.

To sum up, it is my conviction, based upon the results of my experiments, that there is no excuse for not keeping olive trees free from scale insects. In fact, it is great economy to do so. It is a source from which to derive an income on the one hand, and total worthlessness on the other. Those who neglect this important duty, either from indifference or the want of knowledge, will expend their money only to see it melt away before them, and will have for their reward unsuccess, discouragement and despair.

ARTICLE X.

Translation.

[This chapter I have copied entire from the French of *Bertile*, being a *history, culture, products,* and the effect on the public health, etc., which I translate as follows:]

"The touching story of the flight of the dove from Noah's ark, related in Genesis, proves the existence of the olive tree in the earliest period of the world's history.

It was a celebrated tree among the ancients. It held the first rank in their mythology; Minerva taught the Athenians how to prepare the fruit, and they had a most religious respect for it. The oil was used mostly in religious ceremonies by the ancients. The Romans used the wood not only as fuel, but on the altars of their gods; it was the emblem of peace.

The olive tree transported from Egypt to Attica, belongs to the jasmine family, with evergreen foliage, small blossoms in clusters, and having some likeness to the elder tree flowering in June. It can be propagated in many ways, but the best way is by planting the seeds, and it is one which is practiced least. Except in damp soils where its roots rot, the olive grows everywhere. It accustoms itself to both dry and wet climates. Clay and mud are indifferent to it. Its long life is proverbial. In return it takes thirty years, a man's life-time, before it reaches its full capacity for bearing fruit. Of this tree, one of the most valuable gifts of nature, there exists 16 or 17 species, all exotic. Its fruit is oval, fleshy, with a hard woody seed enclosing a kernel. The meat fine and covered with a green skin before its maturity, softens and becomes a purplish black in ripening; it is then that they grind them in the mill, then put them in a press to extract the oil.

With some exceptions one may say that in the Mediterranean Basin, from the 35th degree to the 43d degree of latitude is surrounded with a belt of olive trees. It is from this region that all Europe receives its olive oil, for table use and for light. For either from some trouble in the growth, or some imperfection in the manufacture, perhaps both, the African coast produces very inferior articles which can only be used for lamp oil or grease.

Some of the islands of the Grecian Archipelago and the western shore of the Adriatic produce better oil, but destitute of sweetness and suppleness, qualities most desired by consumers, and only found in the oil made in the valleys south of the Alps. In the center of this region, extending from the promontory of Saint Tropez in France, to Lavona in Italy, in the gulf of Genoa, Nice is situated, whose reputation for the best oil has succeeded all other places in the world.

From the Var to the Roya the valleys that surround it are protected from the north wind by the Alps. The temperature of the winter, which is the season the olive ripens, is the same as spring in the center of France.

This exceptional climate allows the fruit to reach its perfect ripeness, and together with the method of manufacturing gives the superiority which the oil of Nice without question has to-day over all other places. The annual production of this region is valued on an average of four or five million kilograms. The harvest begins in November and lasts until April or May.

There is a crop every two years and lack of rain and intense cold combine in killing the tree. There are many instances of olive trees being bitten by frost, and in this case the tree must be cut to the ground.

The uncertainty of the crops and the biennial yield of fruit cause the high prices of olive oil.

The olives gathered in the vicinity of Nice are all sent to the mill to be pressed into oil. They only pickle those that would not make good oil, and all of the olives we have on our table come from those regions where they do not ripen. The bitter taste they have in this State is destroyed by letting them soak in alkaline water; then by preserving them in brine seasoned with different herbs. By this preparation they become an aperient food, but less nourishing and less digestible.

One only needs to read a good cook-book to find in how many forms oil can be used—but success in the concoction of different dishes can only be obtained by the use of good oil. Failure in such dishes has been many times caused by rancid oil.

Rich in azote, and with considerable nutritive qualities, olive oil possesses, in the first place, the power of assimilating with the human body. It is instrumental in assisting in many medicinal cures where the method is cutaneous. It being more liquid than animal fat, always used for that purpose, it is easier to absorb. The injured parts, protected from the air by oily substances or salves, heal more quickly. These unctions give, besides, more suppleness and elasticity to the muscles. As it is not penetrated by the poisons in the atmosphere, it is used with success in counteracting the deleterious miasma around swampy districts. It ought to be greatly preferred for the hair to pomades, as it acts more quickly on the scalp. Taken daily, by the spoonful, it is an excellent laxative to the system, and not tiresome to the stomach.

It ought to be preferred as a medicine on account of its cheapness and pleasant taste, to those purgative powders so distasteful and expensive.

We read in history of the elasticity and vigor of the Grecians and Romans, and these qualities, without doubt, have been produced by the constant use of olive oil among those ancients. Unlike all animal fat, that is injurious to the stomach and thins the blood, it assists the digestion and permits the body to develop correctly, and the brain to reach the highest stage of human intelligence. Be that as it may, the beneficial effect that olive oil has, over human organism, cannot be disputed.

Originally only eaten where it was made, since the communication between all countries has become so much easier, this article of food is universally used. The most important thing is to get it pure. Unfortunately on account of the cheapness of oils made from seeds and nuts of different kinds, commerce has adulterated olive oil as it has so many other articles. Oils made of peanuts, sesame, cotton, and poppy seeds are sold by millions of kilogrammes under the name of olive oil.

This unwholesome adulteration which can create the most

serious disorders on the digestive organs should be carefully avoided by persons who have any regard for their health.

Mechanics refuse seed oils because of their dryness, as they gum up the machinery instead of greasing it and keeping it clean. It is just as important that the machinery of the human body should rebel against such oils. We ought to be familiar with the methods of extracting oil from all oleaginous substances, being so necessary to different industries. But all the table oil should give the preference to that made from a tree that the Almighty saved from the destruction of the Deluge and a branch of which the dove carried to Noah as a sign of forgiveness."

ARTICLE XI.

THE ADULTERATION OF OLIVE OIL.

I have copied from a paper read before the Liverpool Chemists' Association by Michael Conroy, F. C. S., the same published in the Pharmaceutical Journal, as follows: "The favorite method proposed by M. Poutet, consists in beating up the oil with one-twelfth of its weight of solution of nitrate of mercury. The nitrous acid or nitric peroxide evolved from this converts the oleine of olive oil into elaidin, causing the olive oil, if pure, to become solid in a couple of hours, while the drying oils remain liquid. It will be seen from this that olive oil adulterated with any of the drying oils will not set as hard nor as quickly as genuine olive oil, and that the consistency to which the sample sets, and the time occupied in setting, somewhat roughly indicate the amount of adulteration. A modification of this process is to use nitric acid instead of the solution of nitrate of mercury, and I believe that this plan is practiced by many oil merchants. The *modus operandi* is to mix one-half a fluid drachm of strong nitric acid with about five fluid drachms of the oil in a bottle of one fluid ounce capacity, and to shake up briskly, and put in a cool place for a few hours, when the color and consistency are noted. The results are somewhat similar to those obtained by the nitrate of mercury test. These two tests, are in my opinion, the best published; but they are not satisfactory, inasmuch as it is extremely difficult to judge of the consistency of the results obtained, and, so far as my experience goes, they are useless for samples containing less than ten or fifteen per cent. of seed oils.

The plan which I recommend as more suitable for the purpose is based on an improved method of applying this last test; but instead of being guided by the consistency, I am guided by the

color produced. The test is applied as follows: Mix thoroughly 1 part of strong nitric acid (sp. gr. 1.42) with 9 parts of the oil to be tested, and pour the mixture into a white porcelain dish capable of holding at least ten times the quantity. Apply heat gently, until the action between the acid and the oil is fairly set up, then remove the source of heat and stir well with a glass rod until the action is over.

Pure olive oil thus treated and allowed to cool sets into a pale straw-colored hard mass in an hour or two, while cotton seed and other seed oils assume a deep orange red color, and do not set like olive oil.

In hot weather it is necessary to artificially cool the sample so as to promote the setting; but to a practiced eye the setting is quite unnecessary, the color being sufficiently distinct without.

It will be seen that the delicacy of this test depends upon the great contrast in color exhibited between genuine olive and seed oils, when operated on as described, so that an admixture of 5 per cent. of any seed oil with olive oil is readily detected. Another important feature in this, and possessed by no other test, is the accuracy with which the approximate amount of admixture may be ascertained; and to practically show this feature, I have on the table a sample of genuine olive oil, and one of cotton-seed, and seven other samples, containing respectively 5, 10, 15, 20, 30, 40 and 50 per cent. of cotton-seed oil, which have been treated by this method, and I venture to say that not one will experience any difficulty in picking out the various samples, the gradation in color being so uniform, and I may also add that it is constant. It therefore follows, that if an oil be found to set of a different color to that of a sample of genuine olive, the approximate amount of adulteration can be found by making and operating on a few mixtures containing a known percentage of the adulterant. A little experience in working the test will wonderfully assist in determining the percentage of admixture in any sample, but in all cases I would recommend that the test be performed in conjunction with a sample of genuine olive. The quantities which I have been in the habit of using are, ½ a fluid drachm of nitric acid and 9½ fluid drachms of oil, and having used the test for about three years I can confidently recommend it as thoroughly reliable and constant when carefully carried out. The heat should be removed as soon as the action has fairly started, and the mixture should be kept well stirred until the action is over. Should too much heat be applied, the action becomes violent and unmanageable, and some of the mixture will spurt out of the dish. This spurting, however, may be prevented by placing a plate or other flat body over the dish. The results obtained are never as good when the action is so violent as to cause spurting."

The reputation of the author of the above is sufficient to recommend the certainty of the test—but as all consumers have not the material, or apparatus at hand, they can satisfy themselves of the large percentage of adulteration contained in at least one of the most popular brands imported from Europe by a much simpler method.

Take one bottle of Luca Oil put up by Cross & Blackwell of London, and one bottle of my oil, put both in an ice freezer where the tempature is as low as 35 to 40 degrees Far., and leave them over night. An inspection in the morning will satisfy any one who may now have doubts as to the adulteration of the former.

The adulteration of the Barton & Guestier oil cannot be exposed by this test but your druggist can expose it for you, by the "Couroy" method. I only mention these two brands for the reason that they command the highest price and are the favored importations. While I was engaged in the shipping business in the city of New York, our firm had one telegraph order for one thousand tierces of hog's lard to go to the Mediterranean to adulterate olive oil.

One year's exports of cotton seed oil from New Orleans to the Mediterranean was sufficient in quantity to fill "fifteen million" ordinary oil bottles, the cost of the oil in each bottle being less than ten cents. So long as our people are willing to pay a dollar for what is not worth anything, and which costs less than ten cents, so long will hog's lard and cotton seed, under false labels, be consumed by them as olive oil. As to the effect on the human body of a liberal use of these admixtures, I refer to my previous article or to the writings on the subject, by every intelligent author since the commencement of time.

ARTICLE XII.

CONCLUSION.

With this chapter my articles on olive culture will close. Before closing however, it is necessary to add, as supplementary to article No. 8, that insect pests destructive to the olive as also to citrus fruits, are called by different names. I have in my article used the scientific name of *Coccus oleoe* in speaking of the black scale.

In a very interesting treatise on insect pests published by Mathew Cooke, chief Horticultural officer of this State, this insect is called *Lecanium oleae* given as the classification of Monsieur

V. Signoret of Paris, also in the same book from a paper of Prof. Comstock, this insect is called *Lecanium oleae.* This scientist also claims that he has discovered scale insects not previously described or named. Different names for the same thing is very unfortunate and misleads the investigator. We who have to fight insect pests care very little under what name we fight them, but we want information, and cannot afford the confusion or difficulties to be met with by reason of a multiplicity of names. If scientists who claim the right of the naming power disagree on this important point it detracts from our respect for the importance of their work.

I have adhered to the classification *Coccus* for the reason that all French writers on the olive that I have consulted have done so, with but one exception.

As an authority on this subject I quote from Alfred Le Jourdan in his work *Maladie Noire,* pages 15 to 31.

"These insects form the genus Coccus founded by Linnæus and adopted by the greater number of authors.

1. The *Coccus hesperidum,* Citrus Scale.
2. The *Coccus aonidum,* Oleander Scale.
3. The *Coccus adonidum,* Hot-house Scale.
4. The *Coccus oleoe,* Olive Scale.
5. The *Coccus ficus caricoe,* Scale of the Fig.
6. The *Coccus vitis,* Scale of the Vine.

Some authors have classified these insects by the number of the antennæ, the form of the body, the presence of rings, etc., etc., but these divisions established on characters of very little importance, and which sometimes vary, I think it is more natural to preserve the grand *genus Linneen,* the *Coccus.*

"In the Lecanium they have placed the *Coccus hesperidum,* the *Coccus aonidum,* and the *Coccus oleoe."*

In the classification as above from *one* to *six* these insects have been variously named.

1. The *Coccus hesperidum* the Coccus hypernaculorum, the pediculus clypeatus, the Kermes hesperidum, the lecaniun hesperidum.

2. *Coccus aonidum,* the Coccus indarum arboreum, the Coccus hesperidum minor, the Kermes aonidum, the lecanium aonidum.

3. The *Coccus adonidum,* the pediculus hypernaculorum, the pediculus adonidum, the pediculus coffeœ, the Coccus rufus farinaceus.

4. The *Coccus Oleoe,* the Kermes Oleœ, the lecanium Oleœ,

5. The *Coccus ficus caricoe,* the kermes ficus caricœ, the lecanium ficus caricœ.

6. The *Coccus vitis,* the Kermes vitis.

"These are the principal kinds of coccus, corresponding to a certain extent, and the attack always followed by the black fungus."

"The *Coccus adonidum,* (hot house scale) originated in Senegal and attacks more particularly the Citrus trees, and is very difficult to destroy."

"The *coccus hesperidum* (citrus scale), originated in America or Africa."

"The *coccus aonidum* originated in the Indian Archipelago, and thrives more particularly on the Oleander."

"The *coccus ficus caricoe* commits great ravages on the fig. It produces about the same effect on the fig that the black scale does on the olive, multiplies with great rapidity, but not so rapidly as the olive scale."

"The *coccus oleoe*, so destructive to the olive, is a native of the borders of the Mediterrenean, and increases with the greatest rapidity."

"The *coccus vitis* exercises its destructive action on the vine."

I differ from the conclusions of scientists as to the natural home of some of these insects. They do not, or can not exist where there are many degrees of frost. They do not thrive in the tropics.

The olive was grown successfully for at least four thousand years in parts of Asia, and a very great length of time in Africa, and on the coast of the Mediterranean without being infested with the *Coccus.* It could not be a native of these places. The natural home is in a climate similar to Australia and that of California.

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